CLAIMS

1. A method, comprising:

providing a bulk metal adjacent a semiconductor wire; and

diffusing at least a portion of the bulk metal into at least a portion of the semiconductor wire, the semiconductor wire comprising at least one portion having a smallest dimension of less than about 500 nm.

2. The method of claim 1, wherein the bulk metal comprises a transition metal.

3. The method of claim 2, wherein the transition metal includes at least one of a Group IIIB element, a Group IVB element, a Group VB element, a Group VIB element, a Group VIIB element, and a Group VIIIB element.

4. The method of claim 3, wherein the bulk metal comprises a Group VIIIB element.

5. The method of claim 1, wherein the bulk metal comprises nickel.

6. The method of claim 1, wherein the bulk metal consists essentially of nickel.

7. The method of claim 1, wherein the semiconductor comprises an elemental semiconductor.

8. The method of claim 7, wherein the elemental semiconductor comprises at least one of silicon, gallium, germanium, carbon, tin, selenium, tellurium, boron, or phosphorous.

9. The method of claim 7, wherein the elemental semiconductor comprises a Group IV semiconductor.

10. The method of claim 7, wherein the elemental semiconductor comprises Si.

11. The method of claim 7, wherein the elemental semiconductor consists essentially of Si.

12. The method of claim 1, wherein the smallest dimension is less than 200 nm.

13. The method of claim 1, wherein the smallest dimension is less than 150 nm.

14. The method of claim 1, wherein the smallest dimension is less than 100 nm.

15. The method of claim 1, wherein the smallest dimension is less than 80 nm.

16. The method of claim 1, wherein the smallest dimension is less than 70 nm.

17. The method of claim 1, wherein the smallest dimension is less than 60 nm.

18. The method of claim 1, wherein the smallest dimension is less than 40 nm.

19. The method of claim 1, wherein the smallest dimension is less than 20 nm.

20. The method of claim 1, wherein the smallest dimension is less than 10 nm.

21. The method of claim 1, wherein the smallest dimension is less than 5 nm.

22. The method of claim 1, wherein the wire has an aspect ratio of at least 4:1.

23. The method of claim 1, wherein the wire has an aspect ratio of at least 10:1.

24. The method of claim 1, wherein the wire has an aspect ratio of at least 100:1.

25. The method of claim 1, wherein the wire has an aspect ratio of at least 1000:1.

26. The method of claim 1, wherein the wire is a single crystal.

27. An article, comprising:

a wire comprising at least one metal silicide, the wire being a single crystal.

28. The article of claim 27, wherein the metal comprises a transition metal.

29. The article of claim 28, wherein the transition metal includes at least one of a Group IIIB element, a Group IVB element, a Group VB element, a Group VIB element, a Group VIIB element, and a Group VIIIB element.

30. The article of claim 29, wherein the metal is a Group VIIIB element.

31. The article of claim 30, wherein the metal comprises nickel.

32. The article of claim 27, wherein the wire comprises at least one portion having a smallest dimension of less than about 500 nm.

33. The article of claim 27, wherein the wire has an aspect ratio of at least 4:1.

34. The article of claim 27, wherein the wire is part of a device.

35. The article of claim 34, wherein the device is an electronic device.

36. The article of claim 34, wherein the device is a switch.

37. The article of claim 34, wherein the device is a logic unit.

38. The article of claim 34, wherein the device is a transistor.

39. The article of claim 38, wherein the transistor is a field effect transistor.

40. The article of claim 34, wherein the device comprises a digital circuit.

41. The article of claim 27, wherein the metal silicide comprises a stoichiometric ratio of silicon and at least one metal.

42. The article of claim 27, wherein the wire has a resistivity of less than about 60 microOhm cm.

43. The article of claim 27, wherein the wire is able to carry a current density of at least about 10^8 A/cm^2.

44. An article, comprising:

a wire comprising a compound having a stoichiometric ratio of silicon and at least one metal, the wire comprising at least one portion having a smallest dimension of less than about 500 nm.

45. The article of claim 44, wherein the metal comprises a transition metal.

46. The article of claim 45, wherein the transition metal comprises nickel.

47. The article of claim 44, wherein the wire comprises at least one portion having a smallest dimension of less than about 500 nm.

48. The article of claim 44, wherein the wire has an aspect ratio of at least 4:1.

49. The article of claim 44, wherein the wire is part of a device.

50. The article of claim 44, wherein the wire is a single crystal.

51. The article of claim 44, wherein the wire has a resistivity of less than about 60 microOhm cm.

52. The article of claim 44, wherein the wire is able to carry a current density of at least about 10^8 A/cm^2.

53. The article of claim 44, wherein the wire comprises two regions differing in composition, at least one of the two regions comprising the compound having the stoichiometric ratio of silicon and at least one metal.

54. An article, comprising:

a wire comprising at least one metal silicide, the wire having a resistivity of less than about 60 microOhm cm.

55. The article of claim 54, wherein the metal comprises a transition metal.

56. The article of claim 55, wherein the metal comprises nickel.

57. The article of claim 54, wherein the wire comprises at least one portion having a smallest dimension of less than about 500 nm.

58. The article of claim 54, wherein the wire has an aspect ratio of at least 4:1.

59. The article of claim 54, wherein the wire is part of a device.

60. The article of claim 54, wherein the wire is a single crystal.

61. The article of claim 54, wherein the metal silicide comprises a stoichiometric ratio of silicon and at least one metal.

62. The article of claim 54, wherein the wire is able to carry a current density of at least about 10^8 A/cm^2.

63. The article of claim 54, wherein the wire comprises two regions differing in composition, at least one of the two regions comprising the metal silicide.

64. An article, comprising:

a wire comprising at least one metal silicide, the wire being able to carry a current density of at least about 10^8 A/cm^2.

65. The article of claim 64, wherein the metal comprises a transition metal.

66. The article of claim 65, wherein the metal comprises nickel.

67. The article of claim 64, wherein the wire comprises at least one portion having a smallest dimension of less than about 500 nm.

68. The article of claim 64, wherein the wire has an aspect ratio of at least 4:1.

69. The article of claim 64, wherein the wire is part of a device.

70. The article of claim 64, wherein the wire is a single crystal.

71. The article of claim 64, wherein the metal silicide comprises a stoichiometric ratio of silicon and at least one metal.

72. The article of claim 64, wherein the wire has a resistivity of less than about 60 microOhm cm.

73. The article of claim 64, wherein the wire comprises two regions differing in composition, at least one of the two regions comprising the metal silicide.

74. An article, comprising:

a wire comprising at least two regions differing in composition, at least one region comprising a metal silicide, the wire comprising at least one portion having a smallest dimension of less than about 500 nm.

75. The article of claim 74, wherein the metal comprises a transition metal.

76. The article of claim 75, wherein the metal comprises nickel.

77. The article of claim 74, wherein the wire has an aspect ratio of at least 4:1.

78. The article of claim 74, wherein the wire is part of a device.

79. The article of claim 74, wherein the metal silicide comprises a stoichiometric ratio of silicon and at least one metal.

80. The article of claim 74, wherein the wire has a resistivity of less than about 60 microohm cm.

81. The article of claim 74, wherein the wire is able to carry a current density of at least about 10^8 A/cm^2.

82. The article of claim 74, wherein each of the at least two regions independently comprises a metal silicide.

83. The article of claim 74, wherein two of the at least two regions define a boundary therebetween, the boundary being atomically abrupt.

84. The article of claim 74, the at least two regions comprising a first region having a composition and a second region having a composition different from the first region, the first region and the second region overlapping to form an overlap region having a composition that is a mixture of the compositions of the first and second regions, wherein the composition of the overlap region comprises between about 10 vol% and about 90 vol% of the composition of the first region with a complementary amount of the composition of the second region.

85. An article, comprising:

a wire comprising at least two regions differing in composition and a boundary between the at least two regions, the boundary having a maximum dimension of less than about 500 nm, wherein at least one region comprises a metal silicide.

86. The article of claim 85, wherein the metal comprises a transition metal.

87. The article of claim 86, wherein the metal comprises nickel.

88. The article of claim 85, wherein the wire has an aspect ratio of at least 4:1.

89. The article of claim 85, wherein the wire is part of a device.

90. The article of claim 85, wherein the metal silicide comprises a stoichiometric ratio of silicon and at least one metal.

91. The article of claim 85, wherein the wire has a resistivity of less than about 60 microOhm cm.

92. The article of claim 85, wherein the wire is able to carry a current density of at least about 10^8 A/cm^2.

93. The article of claim 85, wherein the maximum dimension is less than 200 nm.

94. The article of claim 85, wherein the boundary is an atomically abrupt boundary.

95. The article of claim 85, wherein the at least two regions each independently comprises a metal silicide.

96. A method, comprising:

diffusing a material into at least a portion of a wire, the wire comprising at least one portion having a smallest dimension of less than about 500 nm.

97. The method of claim 96, wherein the material comprises a metal.

98. The method of claim 97, wherein the metal comprises nickel.

99. The method of claim 96, wherein the wire comprises a semiconductor.

100. The method of claim 99, wherein the semiconductor comprises silicon.

101. The method of claim 96, comprising diffusing the first material into a first portion of a wire without diffusing the first material into a second portion of the wire.

102. The method of claim 101, wherein the first portion and the second portion of the wire are defined by a mask positioned proximate the wire.

103. The method of claim 102, wherein the mask comprises photoresist.

104. The method of claim 102, wherein the mask comprises a nanoscale wire.

105. The method of claim 104, wherein the nanoscale wire comprises a core and a shell.

106. The method of claim 104, further comprising positioning a mask proximate the semiconductor, the mask defining, at least in part, the portion of the semiconductor that at least a portion of the bulk metal diffuses into.

107. The method of claim 106, wherein the mask comprises photoresist.

108. The method of claim 106, wherein the mask comprises a nanoscale wire.

109. The method of claim 108, wherein the nanoscale wire comprises a core and a shell.

110. A method, comprising:

diffusing a metal into at least a portion of a semiconductor nanoscale wire to form a stoichiometric ratio of metal atoms to semiconductor atoms within the portion of the semiconductor nanoscale wire.

111. The method of claim 110, wherein the metal comprises a transition metal.

112. The method of claim 110, wherein the metal comprises nickel.

113. The method of claim 110, wherein the metal consists essentially of nickel.

114. The method of claim 110, wherein the semiconductor comprises an elemental semiconductor.

115. The method of claim 110, wherein the elemental semiconductor comprises Si.

116. The method of claim 110, wherein the elemental semiconductor consists essentially of Si.

117. A method, comprising:

bulk-doping at least a portion of a nanoscale wire after growth of the nanoscale wire.

118. The method of claim 117, wherein bulk-doping comprises doping a center portion of the nanoscale wire.

119. The method of claim 117, comprising bulk-doping the nanoscale wire to increase the conductivity of the nanoscale wire.

120. The method of claim 117, comprising diffusing a metal into at least a portion of the semiconductor nanoscale wire.

121. A method, comprising:

diffusing a material into a center portion of a semiconductor wire, the semiconductor wire comprising at least one portion having a smallest dimension of less than about 500 nm.

122. The method of claim 121, comprising diffusing at least a portion of the material to alter the conductivity of the portion of the semiconductor wire.

123. The method of claim 121, wherein the material comprises a metal.

124. The method of claim 123, wherein the metal comprises a transition metal.

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125. The method of claim 123, wherein the metal comprises nickel.